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THE MEASUREMENT OF LABOR MOBILITY

I

The flow of industrial workers into and out of our factories, mills, mines, and lumber camps, and their migration from one camp or factory to another are phenomena so varied and complex that it is impossible adequately to discuss them by the loose manipulation of the word "turnover," with its limited scope and ambiguous connotation. It is no less hopeless to try to measure the extent of this labor flow by means of such a narrow and misleading formula as the so-called "percentage of labor turnover," now so commonly resorted to.

The term "labor turnover," if confusion is to be avoided, should either be discontinued or else used very definitely and specifically in reference to some one phase of labor mobility. It would be useful when used in the strict sense either of labor replacement or of labor flux (accessions plus separations). But labor replacement and labor flux, although of primary importance, do not cover the whole problem of labor mobility. There are also to be considered "labor increase" (in concerns which are enlarging their normal work force) and "labor decrease" (in concerns which are cutting down their normal work force). Neither labor increase nor decrease is a part of the so-called "turnover" when that term is defined as replacement, whereas both are a part of it when it is defined as flux. This

means that neither employees hired by an expanding concern to increase the normal work force nor old employees laid off by a dwindling business to decrease it—or employees whose voluntary resignations the employer avails himself of with the same object—figure in the labor replacement.

The expression "labor turnover" has been made still more unsatisfactory by attaching to it a meaning which unnecessarily obscures the problem and makes the term even worse than useless. It has been officially defined by the organized employment managers of the country as "the number of separations from service."[1] It is evident that under some circumstances a part of the separations may be due to reduction of force and, therefore, have nothing to do with labor replacement.

Labor "turnover," then, in its most obvious and literal meaning, has only to do with that part of the labor flow (into and out of the establishment) which is involved in force maintenance. The amount of turnover is the amount of replacement, and no other word than "replacement" need be used in speaking of that aspect of labor mobility which has been generally referred to as "labor turnover." Just as "turnover" is a misleading term for use in reference to the phenomenon of replacement, so the term "percentage" is equally confusing for use in measuring the extent of this phenomenon. We know exactly the extent of the replacement necessary to maintain the normal work force when we know, let us say, that replacements took place in any given concern at the rate of 2 for each full-year worker in the normal work force. In other words, the phrase "rate of replacement" accurately designates what "percentage of turnover" has been loosely used to express.

Other items in the labor flow, and, indeed, its whole volume or flux, may be "rated" in a similar fashion. The rate at which employees leave may be called the separation rate, and the rate at which they are hired the accession rate. Whichever of these two rates is the lower may, for all practical purposes, be used as the

[1] And the "percentage of turnover" as "the ratio of the total number of separations . . . . to the average number of employees on the force report. . . . ." Standard definition of labor turnover and method of computing the percentage of labor turnover, National Conference of Employment Managers, Rochester, New York, May 9 to 11, 1918. *Monthly Labor Review* (June, 1918), pp. 172–73.

replacement rate. When the accession rate exceeds the separation rate, the difference between the two measures the labor increase rate. When the separation rate exceeds the accession rate, their difference measures the labor decrease rate. If the separation and accession rates are equal, either one may, of course, be used as the replacement rate and there is naturally neither increase nor decrease, the concern in question being neither expanding nor curtailing operations. The rates of increase and decrease may be considered as marginal rates in relation to the replacement rates, the increase rate measuring the amount, if any, of inflow over and above replacement inflow and the decrease rate measuring the amount, if any, of outflow over and above the outflow which has to be (and sooner or later is) replaced. The accession rate plus the separation rate gives the total rate of labor change—a single rate of labor flux on the basis of which the mobility of labor in one occupation, shop, industry, or locality may be compared with its mobility in any other occupation, shop, industry, or locality. These different types of labor mobility rates may be classified as follows:

1. Accession rate (or hiring rate)
2. Separation rate
   - quitting rate (leaving voluntarily)
   - discharge rate ("firing" rate)
   - lay-off rate
3. Replacement rate or "turnover" (separations minus excess of separations over accessions)
4. Increase rate (accession rate minus separations rate)
5. Decrease rate (separation rate minus accession rate)
6. Flux rate (accession rate plus separation rate)[1]

The meaning of these different phases of labor mobility and their relation to each other are brought out in a somewhat clearer fashion in Table I, which shows for the years 1917 and 1918 the rate per full-year worker of flux, accession, separation,

[1] The use of the expressions "labor flux," "labor increase," and "labor decrease" has been suggested to the writer by Lucian W. Chaney, of the United States Bureau of Labor Statistics. Mr. Chaney also suggested the term "industrial rates" for use in general reference to labor mobility rates, accident rates, etc. The writer wishes to take this opportunity to express his indebtedness to Mr. Chaney in the whole subject-matter of this paper. Tables I, III, and V are based upon unpublished material in the files of the U.S. Bureau of Labor Statistics.

replacement, and labor increase and decrease in an automobile manufacturing plant.

The marginal flow, mentioned above, made up of excess hirings or excess separations, as the case may be, is not without importance. It is not labor replacement, however. Its importance, so far as force maintenance is concerned, is quite secondary. As a contributing or causal factor in unemployment in general, it is of vital importance both to the employing firm and to the community. Consider, for the moment, not merely the labor replacement involved in the establishment's force maintenance, but its labor

TABLE I

LABOR MOBILITY IN AN AUTOMOBILE MANUFACTURING PLANT, SHOWING FLUX, ACCESSION, SEPARATION, REPLACEMENT, AND LABOR INCREASE AND DECREASE RATES FOR 1917 AND 1918

YEAR	AVERAGE DAILY ABSENTEES	NUMBER OF FULL-YEAR WORKERS	ACCESSIONS PLUS SEPARATIONS (FLUX)	ACCESSIONS	SEPARATIONS	REPLACEMENTS	LABOR INCREASE	LABOR DECREASE
	Number							
1917.....	1,699	35,401	22,791	7,964	14,827	7,964	.....	6,863
1918.....	1,340†	31,911	50,921	26,572	24,349	24,349	2,223	.....
	Rate per Full-Year Worker							
1917.....	0.05	.....	0.64	0.23	0.42	0.23	.....	0.19
1918.....	0.04†	.....	1.60	0.83	0.76	0.76	0.07	.....

† Based on records for first six months only.

mobility situation as a whole. As already noted, this total stability situation is best represented by the sum of the accession and separation rates. This includes not only the accessions and separations which are replaced (and which form the basis of the replacement rate) but also any possible marginal flow (of excess recruits or "quitters,"[1]) expressed in the form of labor increase or decrease rates, as the case may be. This total establishment flow, as already intimated, is perhaps the best single index to the general labor stability situation in any establishment and to its standing as

[1] The word "quitters" is used in these pages in the sense of "terminating" and refers to all employees leaving service, for whatever reason.

compared with other establishments. This total flux figure is quite easily ascertainable and it can be quite easily worked out separately from replacement flux.[1]

From the standpoint of the employee, labor mobility means irregular employment and unemployment. In the present article we are not concerned with unemployment as a community problem or as a personal employee problem but simply as an establishment problem. The primary purpose here is to discuss the measurement of the labor flow into and out of the factory, and especially the measurement of that part of the labor flow which is involved (necessarily or unnecessarily) in the maintenance of the normal work force—the phase of labor mobility usually described as "labor turnover" and here referred to as labor replacement. The latter term expresses the employers' professional interest in unemployment as a phenomenon of the labor flow—into and out of his establishment. He is more concerned about the number of men it is necessary to hire to keep the establishment going than he is about the number of days unemployed individuals may be out of work each year.

II

It is proposed in this paper to make a definite change in computation practice in regard to all the factors entering into the measurement of the labor flow:

1. As to the relatively more variable factor—the industrial ebb and flow of labor—it is suggested that it be measured by (*a*) counting the replacements (i.e., separations which are replaced) instead of either the gross separations or the gross accessions, and (*b*) adding accessions to separations, thus showing the flux.

2. As to the relatively constant factor, or base—the normal or standard working force—it is proposed to use, instead of the average number on the pay-roll, the number of 3,000-hour (or 300-day) workers to which the total hours (or days) put in during the period are considered to be equivalent.[2] This number may be

[1] See chart on p. 457.

[2] The 3,000-hour basic year is a more or less arbitrary standard amount of employment, taken as being roughly equivalent to the amount of labor time normally put in by the average fully employed industrial employee. It is not meant to discount the very real advantages of the eight-hour day.

derived from the labor-time records or, failing such records, the daily attendance records or wages and salary-account records, as explained in another section of this paper. This standard base will be called for convenience "the equivalent full-year worker" or, more briefly, "the full-year worker."

3. It is then proposed, in place of the rate of gross separations per 100 in attendance or the rate of gross accessions per 100 on the pay-roll (both so-called "turnover percentages"), to use as an index of the shifting involved in labor maintenance the rate of replacement per equivalent full-year worker, and as an index to the general stability situation the total labor flux rate per full-year worker, the "full-year worker" being a standard unit, the number of which is obtained by dividing the total number of hours (or days) worked during the period considered by the 3,000 hours (or 300 days) of a standard working year. The rate is arrived at by dividing the number of replacements by the number of "full-year workers." As will be explained in another section of this article, not only this replacement rate, but the hiring, separation, labor increase, labor decrease, and total labor flux rates can each be separately computed and their general trend and their relations to each other readily charted in graphic form.

III

The Employment Managers' Association of Boston defined "labor turnover" as "the change in personnel brought about by hiring and the termination of employment." Here we have, apparently, the identification of labor turnover with a total rate of labor change. It seems more convenient and more accurate to think of "turnover" as referring primarily to the separations from service which must be replaced and to the accessions which are necessary to replace them. What has been described above as marginal flux—the flow of labor due to permanent extension of plant or permanent reduction of force—would be considered as constituting a general employment problem less intimately concerning the individual establishment than the domestic problem of the maintenance of its labor force from day to day.

In addition to the replacement flow directly involved in maintenance of force there is, then, the additional flow incident to the (more or less) permanent building up or cutting down of the size of the standard working force resulting from a permanent addition to plant or the (more or less) permanent discontinuance of some department or the curtailment of operations. It is not implied that this marginal flow of labor is of no concern to the employer or to the employment manager. It is of vital concern to them both. And, furthermore, it is one of the greatest sources of irregular employment and stands even more in need of reduction, perhaps, than does the labor flow which is involved in maintenance of force. The point here made is not that this marginal labor flow is unimportant or free from menace, both to the workers and to the community, but that it should not be dragged in under the same "labor turnover percentage" formula that is intended to measure the rate of labor replacement. The term labor turnover should be (1) identified with the labor flow involved in labor maintenance, or (2) identified with the sum of all accessions to and separations from service, that is, labor flux, or (3) thrown out entirely. The use of a term such as "labor turnover" and especially of such a phrase as "the percentage of labor turnover" seems to be of very doubtful value. The difficulty is that such a formula tempts us to use it without reference to its necessary base. Certainly a clear analysis of any establishment's labor stability situation and an accurate measurement of the extent of its labor instability is possible without reference to a "percentage of turnover." Reference is made to it in this paper merely to point out that the same facts are shown up without it and shown up with less doubt as to their meaning.

The essential thing about labor instability, so far as establishment force maintenance is concerned, is the ratio between the number of replacements made and the standard working force. The natural way to express this ratio is to specify how many replacements are made during, say, one year in order to keep each position in the working force continuously filled. This is, in statistical terms, the rate of replacement per full-year worker.

IV

The employment manager is primarily concerned with the elimination of waste in force maintenance. One of his primary objects at the present time is to cut down the number of replacements involved in keeping up the force. He is necessarily concerned in reducing the marginal flux caused by shut-down and expansion by formulating plans for the regularization of manufacture, etc., but this concern is incidental and he is, moreover, relatively powerless to accomplish much in regard to it. His chief business is accurately to measure and analyze the rates of replacement and flux and to use this information in making his plans for reducing these rates.

Labor replacements, of course, can never be completely eliminated. Indeed, it is hardly probable that they can be reduced to the low point which many employment managers think possible. They, like the rest of us, are rather likely to assume that all labor mobility is evil, except possibly the irreducible minimum caused by death or election to the presidency. Beyond a certain point the reduction of labor mobility is not even desirable. A one hundred per cent reduction in the replacement rate, if it were possible, would be a calamity. Labor which is completely stabilized is completely ossified. Perhaps the ten-day "floaters" in a factory are more enterprising, on the average, than the ten-year "stickers." If this is so and the "turnover" reducers should overreach themselves in their enthusiasm for reduction, the National Association of Employment Managers may sooner or later find itself challenged by a National Association for Increasing the Mobility of Labor. Within wide limits, however, we are all agreed that labor mobility, in the form and degree in which it appears in our modern factory communities, is a menacing evil and a serious waste both to employer and employee. A given degree of instability, of course, is more or less serious according to the industry involved. Thus a rate of 3 per full-year worker would be extraordinary for a mercantile establishment but not for a steel mill. The discussion in this paper proceeds on the assumption that a great part of the country's labor mobility is unnecessary and that it is therefore very important to measure its extent.

V

The problem of the measurement of the ebb and flow of labor through our industrial establishments has reached a point where a reconsideration of currently accepted methods is a matter of urgent necessity. As matters stand at present, employment managers and students of the labor problem are in danger of having clamped down on them a working method for the measurement of the flow of labor through the factory which distorts the facts as to the stability of labor and makes practically impossible all comparisons of results for different plants, industries, and localities.

The principal agencies which have been engaged in the discussion of this problem and the elaboration of methods of measurement and amelioration are the various employment managers' associations and the United States Bureau of Labor Statistics. In May, 1918, the National Association of Employment Managers met in Rochester, New York. This conference spent some hours in the discussion of methods of computing "turnover," decided "that turnover figures be confined to 'exits' without qualifying phrase," that is, that it include all separations, and appointed a committee to formulate a definition of labor turnover and work out a method of turnover computation.[1] This committee formulated the following "standard definition . . . . and method of computing the percentage of labor turnover":

> The percentage of labor turnover for any period considered is the ratio of the total number of separations during the period to the average number of employees on the force report during that period. The force report gives the number of men actually working each day as shown by attendance records. . . . . To compute the percentage of labor turnover for any period, find the total separations for the period considered and divide by the average of the number actually working each day throughout the period.[2]

The foregoing standard definition and computation formula has received the indorsement of the Bureau of Labor Statistics and has been followed (less and less closely, however, from month to month)

[1] The discussion is published in the "Proceedings of the Employment Managers' Conference, Rochester, New York," *Bulletin 247*, United States Bureau of Labor Statistics, pp. 206–13.

[2] The committee's report appears in full in the *Monthly Labor Review*, June, 1918, pp. 168–77.

in the reports on labor "turnover" which the Bureau has been publishing in its *Monthly Labor Review* during the past year.[1] In its earlier studies of the subject the Bureau computed the turnover by dividing the number of replacements by the average number on the pay-roll. This was the method used in its report on "Street Railway Employment"[2] and in an article on "Labor Turnover of Seamen on the Great Lakes" published in the month following the Rochester convention.[3] Moreover, at that very convention the Bureau's chief statistician insisted that "turnover" should be identified with replacements.[4]

It is quite evident that the employment managers are not by any means unanimous in their approval of the Rochester formula. In a symposium on "labor turnover" computation published in the September, 1918, number of *Industrial Management*, the majority of those contributing expressed themselves as opposed to the gross separations item, at least, in the Rochester formula.[5] The February, 1919, number of the same magazine contained an elaborate article on this subject, which, although not convincing in other particulars, was clear as to the superiority of replacements over gross separations.[6]

[1] *Monthly Labor Review*, October, 1918; January, February, March, April, May, September, November, and December, 1919. However, the Bureau has lately made a complete change in its method of computation. See note 1 on p. 30.

[2] "Street Railway Employment in the United States," *Bulletin 204*, pp. 193–203.

[3] Emil Frankel, "Labor Turnover of Seamen on the Great Lakes," *Monthly Labor Review*, VI (June, 1918), pp. 1408–15. See especially the table on p. 1410 containing crew turnover figures based on replacements.

[4] Proceedings, Bureau of Labor Statistics, *Bulletin 247*, p. 209.

[5] *Industrial Management*, September, 1918, pp. 239–45.

[6] Winthrop Talbot, "Labor Maintenance and Its Indices," *Industrial Management*, February, 1919, pp. 127–30. A defense of the use of separations in computing the index of stability is made by Mr. H. G. Hayes in the *American Economic Review*, December, 1919, pp. 903–5, in commenting upon the replacements-divided-by-average-pay-roll formula suggested by Mr. Paul H. Douglas in the June issue of the same journal (pp. 402–5). In the March, 1920, issue Mr. Douglas makes a rejoinder to Mr. Hayes (pp. 106–8). A more completely worked out analysis of the merits of replacements versus separations as units of measurment is made by Mr. S. H. Slichter in the *Quarterly Journal of Economics* for February, 1920 (pp. 329–45). Mr. Slichter favors separations, but apparently fails to realize that, without considering the accessions, he is reporting only a part of the labor change situation—the ebb without the flow. He also makes a well-considered plea for the retention of the word "turnover."

VI

The figure obtained by adding the accessions to the separations indicates the volume of change or the total amount of shifting in the establishment personnel, but throws no light on the crucial question, How much replacement was necessary to maintain the standard force? It is evident that, in an industry or establishment which is cutting down its force, the accessions to that force most accurately measure the amount of replacement. Practically, then, we have replacements identified with the number leaving when a business is "on the make" and with the number hired when it is on the decline. The inescapable result is a net separation or replacement figure. The margin is something apart from replacement: where it is made up of an excess of accessions it marks an increase in the standard working force—the base in our calculation—and a decrease in the amount of unemployment in the community; where it is made up of an excess of separations it marks a decrease in the base—and an increase in the amount of unemployment in the community.

Labor turnover has to do with labor replacements, and the formula for its computation must measure replacements. This is the acid test of any turnover computation formula which is expected accurately to measure labor stability during periods of industrial shut-down as well as in times of industrial expansion. The Rochester formula does not meet this test, for the reason that that formula measures turnover by total separations. Two years ago industry was expanding. The number of separations from service, therefore, was less than the number of accessions to service. In these circumstances all of the separations must have been replaced. At that time, then, the formula correctly measured replacements. After the armistice the situation was reversed. Separations, in general, exceeded accessions. Some of them, therefore, were not replacements. In such circumstances the number of accessions is the closest approximation to the number of replacements and that number, and not the number of separations, should be divided by the number of full-year workers to get the replacement rate. We are concerned with net separations and not with total separations. The method suggested may be put briefly: When the

accessions exceed the separations, divide the separations by the number of full-year workers; when the separations exceed the accessions, divide the accessions by the number of full-year workers. This

TABLE II

LABOR TURNOVER AND NATURE OF SEPARATIONS DURING THE YEAR ENDING JUNE 1, 1918, SHOWING THE NUMBER, PER CENT DISTRIBUTION, AND RATE PER FULL-YEAR WORKER IN EACH MINE OR PLANT DIVISION*

MINE OR PLANT DIVISION	AVERAGE NUMBER OF FULL-YEAR WORKERS	EMPLOYEES HIRED DURING THE YEAR	SEPARATIONS						"PER CENT OF TURNOVER" (ROCHESTER FORMULA)†
			Discharged	Entered Military Service	Quit	Total Classified	No Record	Grand Total	
	1	2	3	4	5	6	7	8	9
	Number								
Mine A	58	210	29	.....	115	144	29	173*	.....
Mine B	247	883*	281	13	921	1,215	45	1,260	.....
Smelter	391	950*	140‡	37	768	945	61	1,006	.....
Electrozinc plant	138	567*	88	5	488	581	10	591	.....
Total	834	2,610*	538	55	2,292	2,885	145	3,030	.....
	Per Cent Distribution of Separations								
Mine A	.....	.....	20	.....	80	100	.....	.....	.....
Mine B	.....	.....	23	1	76	100	.....	.....	.....
Smelter	.....	.....	15	4	81	100	.....	.....	.....
Electrozinc plant	.....	.....	15	1	84	100	.....	.....	.....
Total	.....	.....	19	2	79	100	.....	.....	.....
	Rate per Full-Year Worker								
Mine A	.....	3.6	0.5	.....	2.0	2.5	0.5	3.0*	298*
Mine B	.....	3.6*	1.1	0.1	3.3	4.9	0.2	5.1	510
Smelter	.....	2.4*	0.4	0.1	2.0	2.4	0.2	2.6	257
Electrozinc plant	.....	4.1*	0.5	.....§	3.5	4.2	0.1	4.3	428
Total	.....	3.1*	0.6	0.1	2.7	3.5	0.2	3.6	363

* Replacement numbers and rates are marked by asterisks.

† That is, the separation rate per 100 on the work force.

‡ Including 47 who were laid off for indefinite periods on account of lack of work.

§ Less than 0.05.

elimination of the excess of separations over accessions or vice versa, as the case may be, trims the labor flow down to actual replacements.

The relation between the numbers of separations and accessions and the identification of the replacements are shown in Table II, which is reproduced, with some revision, from an article by the

writer in the May, 1919, number of the *Monthly Labor Review*.[1] It shows the labor flux during the year ending June 1, 1918, among different classes of employees in a California copper mining and smelting plant.

In this table replacements are indicated by asterisks. The number of replacements, divided by what may provisionally be called the normal number of employees, gives a rate of replacement. This may be expressed as a rate per 100, as a rate per 1,000, or as a rate per single full-year worker, as desired. The "per cent of turnover" figures in column 9 are easily seen to be simply the rate of gross separation per 100 normally employed. The rates per full-year worker of both separation and accession are given at the bottom of the table. It is to be noted that in one division (Mine A), where the separations are less than the accessions and where they are, consequently, identical with replacements, the replacement rate is identical with the Rochester turnover percentage, except that one is a rate per single full-year worker and the other a rate per 100. An inspection of the table shows that a special series of "turnover" rates or percentages is quite unnecessary and befogs the issue. The whole stability situation as to frequency of hiring, of separation, and of replacement is revealed in the rates at the bottom of the table. In the plant as a whole during the year there were 3.6 separations, 3.1 accessions, and 3.1 replacements per full-year worker.[2]

VII

The whole significance of the use of replacements rather than gross separations as an index of labor flux, as well as the relation between the accession, separation, and replacement rates, is best brought out by the use of data showing the average number of employees and the number hired and leaving by months over a fairly long period. This will give some notion as to the trend of accessions, separations, and replacements. Such illustrative data are contained in Table III. The figures presented are from a metal

[1] "Labor Turnover among Employees of a California Copper Mining and Smelting Company," *Monthly Labor Review*, viii (May 1919), p. 66.

[2] See the detailed discussion of this subject in the article from which Table II is taken, *Monthly Labor Review*, May, 1919, pp. 65–71.

TABLE III

TREND OF LABOR FLUX, ACCESSION, CLASSIFIED SEPARATION, AND REPLACEMENT RATE IN A METAL PRODUCTS MANUFACTURING PLANT, BY MONTHS, FROM 1912 TO 1919

YEAR ENDING WITH	AVERAGE NUMBER OF FULL-YEAR WORKERS	MOVING ANNUAL RATES PER FULL-YEAR WORKER					
		Labor Flux (Separations plus Accessions)	Total Accessions*	Classified Separations			
				Total*	Left Voluntarily	Laid off	Discharged
December 31, 1912...	1,088	4.10	2.20	*1.90**	1.23	0.43	0.25
January 31, 1913.....	1,114	4.21	2.28	*1.93**	1.28	0.40	0.26
February 29 (28).....	1,138	4.18	2.22	*1.97**	1.31	0.41	0.25
March 30.....	1,158	4.05	2.14	*1.91**	1.24	0.42	0.25
April 30.....	1,174	3.96	2.08	*1.88**	1.21	0.41	0.25
May 31.....	1,185	3.96	2.09	*1.88**	1.21	0.42	0.24
June 30.....	1,214	3.98	2.18	*1.80**	1.28	0.27	0.24
July 31.....	1,241	4.03	2.05	*1.97**	1.29	0.44	0.24
August 31.....	1,245	4.02	2.04	*1.98**	1.27	0.46	0.24
September 30.....	1,248	3.98	2.02	*1.96**	1.26	0.46	0.24
October 31.....	1,258	4.03	2.04	*1.99**	1.24	0.49	0.26
November 30.....	1,264	3.91	1.96	*1.95**	1.21	0.48	0.26
December 31.....	1,262	3.68	*1.81**	1.87	1.14	0.47	0.25
January 31, 1914.....	1,259	3.51	*1.73**	1.78	1.07	0.47	0.24
February 29 (28).....	1,262	3.43	*1.70**	1.73	1.01	0.47	0.24
March 30.....	1,267	3.38	1.71	*1.67**	.96	0.47	0.24
April 30.....	1,276	3.18	1.60	*1.57**	.86	0.49	0.22
May 31.....	1,277	3.02	1.53	*1.50**	.75	0.53	0.22
June 30.....	1,293	2.86	1.51	*1.36**	.64	0.50	0.22
July 31.....	1,299	2.96	1.49	*1.48**	.61	0.64	0.22
August 31.....	1,293	2.89	*1.39**	1.50	.51	0.77	0.21
September 30.....	1,279	2.81	*1.33**	1.49	.49	0.80	0.20
October 31.....	1,260	2.68	*1.26**	1.43	.46	0.79	0.18
November 30.....	1,252	2.70	*1.26**	1.44	.45	0.80	0.18
December 31.....	1,234	2.58	*1.16**	1.42	.44	0.81	0.16
January 31, 1915.....	1,217	2.55	*1.17**	1.39	.42	0.81	0.16
February 29 (28).....	1,197	2.50	*1.12**	1.38	.41	0.81	0.15
March 30.....	1,176	2.40	*1.07**	1.33	.39	0.81	0.12
April 30.....	1,152	2.31	*1.01**	1.30	.39	0.79	0.12
May 31.....	1,136	2.12	*.87**	1.24	.39	0.75	0.11
June 30.....	1,088	1.93	*.68**	1.24	.36	0.79	0.09
July 31.....	1,053	1.70	*.71**	.99	.38	0.53	0.07
August 31.....	1,049	1.60	*.73**	.87	.42	0.38	0.07
September 30.....	1,050	1.63	*.76**	.87	.44	0.36	0.07
October 31.....	1,050	1.62	*.76**	.86	.46	0.34	0.07
November 30.....	1,047	1.59	*.73**	.86	.50	0.32	0.05
December 31.....	1,047	1.90	1.00	*.91**	.54	0.31	0.05
January 31, 1916.....	1,062	2.45	1.31	*1.14**	.76	0.32	0.07
February 29 (28).....	1,091	2.93	1.60	*1.32**	.92	0.31	0.09
March 30.....	1,111	3.36	1.78	*1.58**	1.17	0.30	0.11
April 30.....	1,128	3.97	2.08	*1.89**	1.49	0.29	0.11
May 31.....	1,152	4.64	2.43	*2.21**	1.80	0.29	0.12
June 30.....	1,188	5.02	2.70	*2.32**	2.00	0.18	0.14

* The replacement rates are marked with an asterisk.

TABLE III—*Continued*

Year Ending with	Average Number of Full-Year Workers	Moving Annual Rates per Full-Year Worker					
		Labor Flux (Separations Plus Accessions)	Total Accessions*	Classified Separations			
				Total*	Left Voluntarily	Laid off	Discharged
July 31	1,225	5.22	2.75	*2.47**	2.17	0.13	0.16
August 31	1,249	5.59	2.95	*2.65**	2.35	0.12	0.18
September 30	1,281	5.90	3.09	*2.81**	2.52	0.10	0.19
October 31	1,314	6.28	3.32	*2.97**	2.67	0.10	0.20
November 30	1,355	6.67	3.60	*3.08**	2.77	0.09	0.21
December 31	1,392	6.63	3.45	*3.18**	2.88	0.09	0.21
January 31, 1917	1,406	6.40	3.25	*3.15**	2.86	0.08	0.20
February 29 (28)	1,413	6.33	3.20	*3.12**	2.85	0.08	0.20
March 30	1,433	6.35	3.25	*3.10**	2.83	0.07	0.20
April 30	1,456	6.27	3.21	*3.06**	2.79	0.07	0.20
May 31	1,463	6.21	3.15	*3.06**	2.78	0.08	0.20
June 30	1,466	6.20	3.15	*3.05**	2.79	0.06	0.20
July 31	1,489	6.47	3.36	*3.11**	2.90	0.03	0.19
August 31	1,515	6.78	3.55	*3.23**	3.02	0.03	0.18
September 30	1,536	7.03	3.69	*3.35**	3.13	0.03	0.19
October 31	1,563	7.05	3.68	*3.37**	3.14	0.04	0.19
November 30	1,588	6.93	3.57	*3.36**	3.13	0.04	0.20
December 31	1,606	6.83	3.49	*3.33**	3.08	0.06	0.20
January 31, 1918	1,625	6.73	3.45	*3.28**	3.02	0.06	0.20
February 29 (28)	1,634	6.64	3.36	*3.28**	3.03	0.06	0.18
March 30	1,637	6.57	3.30	*3.27**	3.04	0.06	0.17
April 30	1,636	6.48	3.29	*3.19**	2.95	0.07	0.17
May 31	1,651	6.23	3.13	*3.10**	2.87	0.07	0.17
June 30	1,641	6.07	*3.02**	3.05	2.83	0.07	0.16
July 31	1,645	6.04	3.09	*2.95**	2.73	0.06	0.16
August 31	1,652	5.76	2.90	*2.86**	2.62	0.07	0.17
September 30	1,654	5.70	2.86	*2.84**	2.60	0.07	0.17
October 31	1,642	6.08	*2.81**	3.28	2.65	0.46	0.17
November 30	1,591	6.42	*3.08**	3.34	2.67	0.51	0.16
December 31	1,560	6.59	*3.26**	3.33	2.67	0.49	0.17
January 31, 1919	1,547	6.77	3.40	*3.37**	2.70	0.49	0.19
February 29 (28)	1,530	6.75	*3.34**	3.41	2.67	0.54	0.20
March 30	1,512	6.55	*3.21**	3.34	2.56	0.56	0.22
April 30	1,475	6.39	*3.01**	3.38	2.47	0.67	0.25

* The replacement rates are marked with an asterisk.

products manufacturing establishment in the Middle West. They show for the twelve-month periods indicated the rates of labor change (flux, accession, and classified separation) per full-year worker. They are, in other words, "smoothed" rates derived (by the method of moving averages) from the actual rates for each month, which latter in turn are computed by dividing the actual

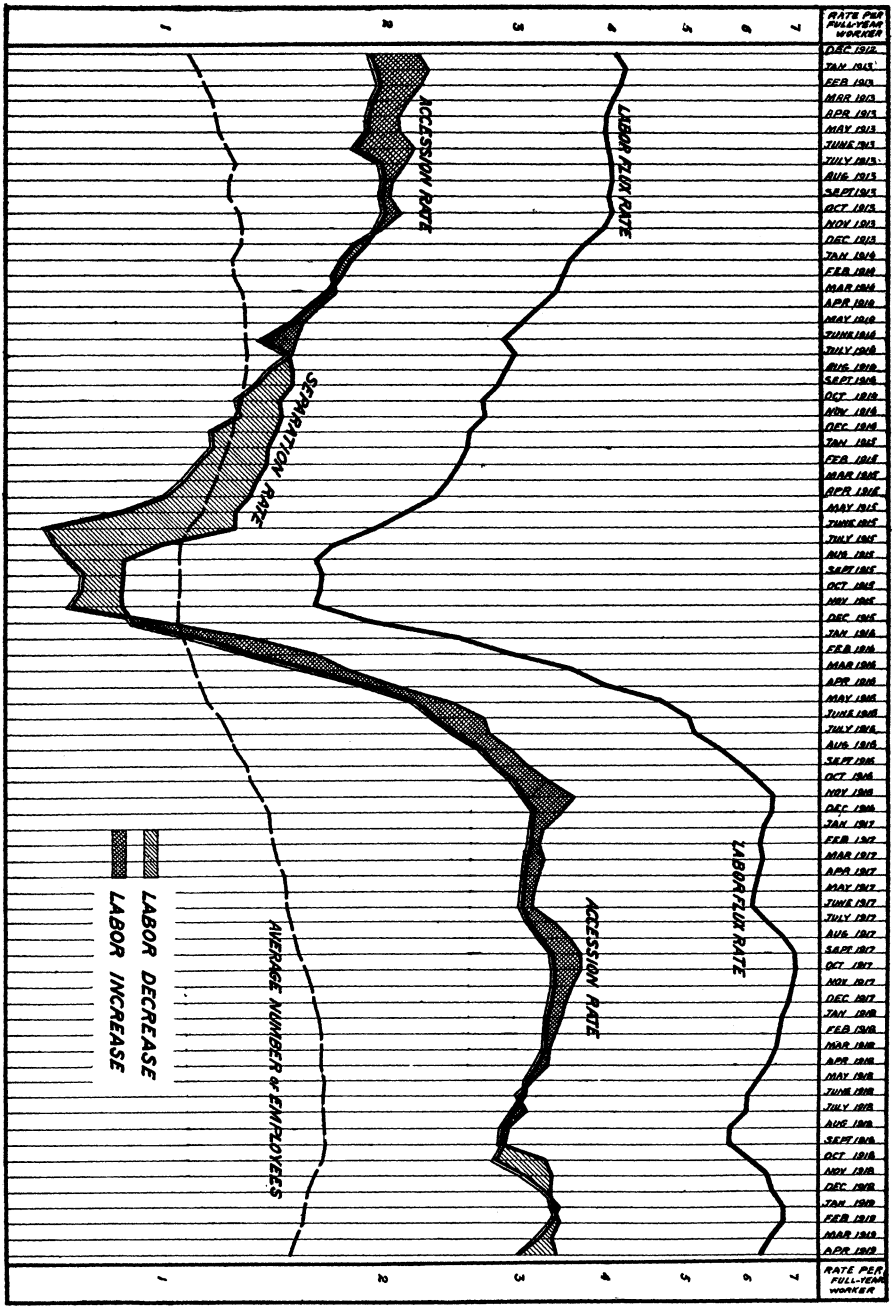
number of labor changes of each particular kind that occurred during each month (the variable) by the number of full-year workers[1] employed during that month (the base). Thus, e.g., the figure 2.20 at the top of the accessions column is the accession rate for the twelve-month period ending December 31, 1912, and the figure 2.28 is the rate for the twelve-month period ending January 31, 1913, etc. Replacement rates among total separations and accessions are indicated by asterisks.

The moving annual labor change rates given in Table III for the overlapping twelve-month periods are shown graphically in the chart on p. 457.[2] The two curves marked accessions and separations tell the whole story. There are obviously two main movements. There was a distinct downward movement—a movement toward greater stability—during the greater part of the four-year period, 1912–15. The following four years—the years of the world-war—witnessed a movement, quite precipitate at first, toward greater mobility. The accession and separation rates follow a roughly parallel course during the seven-year period. The average number of employees underwent a slight increase. The flux rate curve shows a form roughly corresponding, of course, to the trend of accessions and separations. It was 4.10 per full-year worker in 1912, 1.91 in 1915, and 6.39 in 1919. The replacement curve (marking the trend of the starred figures in Table III) is shown on the chart by a line drawn parallel to a line connecting the lower points in the lines showing accessions and separations. It is evident that at the beginning of the period accessions were in excess, so that separations measured replacements, whereas at the end of the period the reverse relation held true and accessions consequently measured replacements.

In 1912 employees in this particular factory were being replaced at the rate of 1.90, in 1915 at the rate of 0.91, and in 1919 at the rate of 3.01 per full-year worker. Either the replacement curve or the flux curve would seem to serve quite well as single indices of the labor stability situation. The labor flux rate was cut down 54 per cent during the period from January 1, 1912, to December 31,

[1] That is to say, 3,000-hour workers, as explained above.

[2] The chart was drawn by Mr. Leon Kirsch, of the United States Bureau of Labor Statistics.


RATE PER FULL-YEAR WORKER
1
2
3
4
5
6
7
DEC 1912
JAN 1913
FEB 1913
MAR 1913
APR 1913
MAY 1913
JUNE 1913
JULY 1913
AUG 1913
SEPT 1913
OCT 1913
NOV 1913
DEC 1913
JAN 1914
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MAY 1914
JUNE 1914
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FEB 1918
MAR 1918
APR 1918
MAY 1918
JUNE 1918
JULY 1918
AUG 1918
SEPT 1918
OCT 1918
NOV 1918
DEC 1918
JAN 1919
FEB 1919
MAR 1919
APR 1919
ACCESSION RATE
SEPARATION RATE
LABOR FLUX RATE
LABOR FLUX RATE
ACCESSION RATE
AVERAGE NUMBER OF EMPLOYEES
LABOR DECREASE
LABOR INCREASE
RATE PER FULL-YEAR WORKER

1915, but between the latter date and April 30, 1919, it underwent an increase of 235 per cent.

When the accessions are in excess of the separations, the factory is building up its force, and the extent to which they are in excess measures the amount of recruiting being done. When the separations, on the other hand, exceed the accessions, the factory must be cutting down its operations and reducing its force, and the margin by which the separations are in excess measures the amount of labor decrease. In the chart the dark shaded areas show the extent of labor increase and the light shaded areas the extent of labor decrease.

An examination of the discharge, lay-off, and voluntary quitting rates in Table III indicates that it was the great increase in the number of men laid off in the latter part of 1914 that raised the separation rate during that time so considerably above the accession rate. This shows how inaccurate the separation curve would be if taken to measure "turnover"—unless that term is to be used in reference to something entirely different from the amount of change involved in maintenance, that is to say, replacement. Almost the whole margin, in this part of the period, between the separation and accession rates is due to increased lay-offs, i.e., to a (more or less) permanent decrease in the size of the standard working force. Remarkable reductions took place during the first three and a half years in both the quitting and discharge rates. When the war began in Europe, this establishment had, apparently, gone a long way toward the elimination of discharges as a factor in turnover, having reduced its rate of discharge from 0.25 to 0.05 per full-year worker, or 78 per cent. But during the war period from December 31, 1915, to April 30, 1919, the discharge rate increased 400 per cent. The most important pre-war reduction is, of course, in the quitting rate, because the quitters are responsible for the bulk of the turnover. This company's quitting rate went down from 1.23 per full-year worker in January, 1912, to 0.54 in December, 1915, a decline of 56 per cent. But the quitting rate increased 357 per cent between December 31, 1915, and April 30, 1919. It is important to note, finally, that it is the voluntary quitting rate which primarily determines the total separation rate.

The disturbing effect of war conditions is very evident. Both accession and separation rates had risen in 1918 to points far above the high points of the 1912–15 period. A comparison of the accession, separation, replacement, and labor flux rates shown in Table III for the 12-month periods ending December 31, 1912, December 31, 1915, December 31, 1918, and April 30, 1919, is made in Table IV. This alignment shows that in this plant, at least, the war pushed all rates except the lay-off rate well above the remarkably favorable low points reached in 1915. Worse

TABLE IV

ANNUAL ACCESSION, REPLACEMENT, AND SEPARATION RATES IN A METAL PRODUCTS MANUFACTURING ESTABLISHMENT

TYPE OF RATE	RATES FOR 12-MONTH PERIODS ENDING			
	Dec. 31, 1912	Dec. 31, 1915	Dec. 31, 1918	April 30, 1919
Flux	4.10	1.91	6.59	6.39
Accession	2.20	1.00	3.26	3.01
Replacement*	*1.90**	*0.91**	*3.26**	*3.01**
Separation	1.90	0.91	3.33	3.38
Quitting	1.23	0.54	2.67	2.47
Lay-off	0.43	0.31	0.49	0.67
Discharge	0.25	0.05	0.17	0.25

* Replacement rates are marked with asterisks.

yet, it pushed all except the lay-off and discharge rates back to a point even higher than the maximum rates of 1912, so that the total separation and accession rates and the replacement rate, which in this case is identical with the separation rate, rose to points never before reached within the period covered by the figures reported. It is interesting to note the effect of the war on the lay-off rate. During the period 1912–15 it was reduced 28 per cent. War conditions apparently greatly accelerated this reduction and showed a lay-off rate of 0.07 per full-year worker for the year ending May 31, 1918, as compared with 0.31 for the calendar year 1915—a reduction of 77 per cent. But in the latter part of 1918, the lay-off rate began to rise and the rate for the year ending April 30, 1919, stood at 0.67, the highest it had been since 1915. Despite the increased war demand for labor the discharge rate

increased from 0.05 per full-year worker in 1915 to 0.17 in 1918—an increase of 209 per cent. It has continued to rise, and stood at 0.25 for the year ending April 30, 1919.

VIII

In the preceding discussion the problem of the base in the calculation of labor stability has been carefully avoided. Premature controversy about it has been avoided by use of the very general phrase: the "standard" or "normal" working force. As a matter of fact, no one, so far as the writer is aware, has yet used a genuine standard base in measuring labor mobility. Several near-standards have been used. The Bureau of Labor Statistics in its first investigation took the average of the weekly, fortnightly, or monthly numbers on the pay-roll as representing the standard working force. This is a padded "standard," as will soon be made evident. The Rochester Conference, it has been noted, proposed that the average number actually working from day to day be considered the "standard" working force. This, it is believed, comes nearer to a genuine standard base than any other standard which has been proposed. The difficulty with both these methods is that they are not standards at all in the proper sense of the word. They may, indeed, constitute fairly accurate bases for determining the rate of labor flow in any particular establishment, but they do not constitute any common base for different establishments.

The average daily attendance plan was proposed very largely because it approximates more closely the average number of full-year workers. Since the amount of shifting involved in force maintenance is measured by the ratio between the number of replacements made and the average number of workers who are continuously employed throughout the period, it is evident that the requisite standard is to be arrived at by somehow pruning down the pay-roll figures to the equivalent number of full-year workers, as defined above.

It is suggested that this pruning can be done most effectively and done in a way most conducive to standardization by using as an ultimate base the actual number of hours (or, failing a record of labor hours, the number of days) put in during the period considered.

This aggregate total of labor hours can easily be reduced to standard-full-year-worker units, as already indicated, by dividing it by 3,000 if it is expressed in hours, or by 300 if it is expressed in days.

A simplified example may serve to make this matter more clear: Assume, for statistical purposes, instead of a 365-day year, a 300-day year, which, in fact, is fairly close for industry generally to the actual working time. And for the sake of convenience and uniformity and without reflecting on the merits of the shorter work-day, assume also a 10-hour day. Then the standard year is 3,000 hours. Now take a hypothetical plant where during the year

100 men are each employed 3,000 hours, making altogether 300,000 hours,
100 men are each employed 1,500 hours, making altogether 150,000 hours,
100 men are each employed 2,700 hours
and each is absent 300 hours, making altogether 300,000 hours,
and an aggregate total of 750,000 hours,

If we take the number on the pay-roll we have 300 as the "standard" working force. By dividing the 750,000 man-hours of employment by 3,000, we get 250 as a standard working force based on the equivalent number of full-year employees. If the 30,000 absentee hours are not recorded and so necessarily left out of the calculation, we have 720,000 man-hours of employment—or, better, man-hours actually worked—divided by 300, giving 240 as the standard working force based on the equivalent number of full-time workers. We have, then, three figures for the standard working force: (1) 300, on the average pay-roll basis; (2) 250, on the labor-hours plus absentee-hours basis; (3) 240, on the bare labor-hours basis.

It is believed that the "average pay-roll" basis can be at once eliminated as an inflated and inaccurate base. Some appreciation of the amount of this inflation, due to dead and broken-time names on the pay-roll, may be had by an examination of Table V, which shows, for each month of the year 1915, the average daily work force (or average daily attendance), the average daily number of absentees, the total number on the pay-roll, and the amount of "dead" or broken time on the pay-roll due to persons separating but not being removed from the pay-roll until after the end of the pay-roll period. The figures are from the metal products manufacturing concern already referred to.

The figures of Table V indicate that, for the year as a whole, the daily work force in actual attendance is about 90 per cent of the total number on the pay-roll and that the absentees average about 2 per cent of the daily work force. The sum of the labor time actually worked (average daily work force) and absentee time falls far short of the total pay-roll figure. The difference, amounting to about 8 per cent of the average number actually working in this plant in 1915, is due to the fact that there necessarily remain

TABLE V

RELATION BETWEEN AVERAGE DAILY NUMBER ACTUALLY WORKING, AVERAGE DAILY NUMBER OF ABSENTEES, AND TOTAL NAMES ON PAY-ROLL, BY MONTHS, 1915

MONTH	AVERAGE DAILY WORK FORCE	AVERAGE DAILY ABSENTEES		PERSONS LEAVING BUT NOT REMOVED FROM PAY-ROLL UNTIL AFTER END OF PAY PERIOD		TOTAL NUMBER OF NAMES ON PAY-ROLL	PER CENT DAILY WORK FORCE IS OF TOTAL PAY-ROLL
		Number	Per Cent of Daily Work Force	Number	Per Cent of Daily Work Force		
January	1,136	16.2	1.4	109.8	9.7	1,262	90
February	1,157	23.5	2.0	75.5	6.5	1,256	92
March	1,218	19.1	1.6	100.9	8.3	1,338	91
April	1,229	24.2	2.0	68.8	5.6	1,322	93
May	1,230	28.0	2.3	37.0	3.0	1,295	95
June	1,116	19.8	1.8	77.2	6.9	1,213	92
July	847	12.7	1.5	51.3	6.1	911	93
August	915	14.0	1.5	111.0	12.1	1,040	88
September	908	16.0	1.8	74.0	8.1	988	91
October	902	19.9	2.2	58.1	6.4	980	92
November	888	17.0	1.9	140.0	15.8	1,045	85
December	1,023	31.0	3.0	95.0	9.3	1,149	89

on the pay-roll through the pay period, if not longer, the names of those employees who left during the pay period and who, consequently, had served only for a part of the pay period. This means that the full and active working complement is only about 90 per cent of the apparent complement shown on the pay-roll. A small part of the remaining 10 per cent is accounted for by absentees, but the bulk of it is due to the counting of the names of those employees who served only a part of the pay period but whose names were not dropped from the pay-roll until after the end of the pay period. This margin by which worked time plus absentee time falls short of the total pay-roll figures may be called the margin of broken

time. It is obvious that the gross pay-roll figures must be discounted for this margin. When this is done there is left the average number of full-year employees (including absentees); when absentee time, finally, is deducted there is left the actual average daily attendance which can easily be expressed in terms of 3,000-hour workers.[1] The foregoing necessary corrections of the gross pay-roll figures force the conclusion that the true base in labor mobility rate calculation must be the actual labor time put in, preferably but not necessarily exclusive of absentee time, and expressed in some such standard equivalent unit as the 3,000-hour, or full-year, worker.

The superiority of labor time (which is the discounted pay-roll) over total pay-roll and over labor-plus-absentee time as a base for computation is evident at once from an examination of Table V. The proportions both of broken time and absentee time are subject to wide fluctuations, and their inclusion in the base would unquestionably make it less of a constant and more of a variable. A standard unit of measurement should obviously be really a standard, that is to say, it should be as unvarying as possible. The use of labor hours (in 3,000-hour units) provides an unvarying unit amount of employment and at the same time eliminates the factors of absentee and "broken pay-roll time," both of which are subject to wide fluctuations from month to month in the same plant, and, more especially, show enormous differences between establishments and industries.

IX

The difficulty in regard to absentee time is intensified by the fact that the actual industrial practice in regard to it varies so widely between different plants. Some employers immediately hire new workers to take the place of those who are absent. Others contrive to get along without the absentees and do not try to replace them unless they fail to return after a specified time, the length of which time varies from plant to plant. Obviously, in those plants where absentees are treated in exactly the same way as quitters,

[1] Viz., by multiplying the average daily attendance by the hours worked per day, that product by the days worked per year, and dividing the resultant number of labor hours by 3,000.

their absent time should be excluded from the computation of the standard working force. Where the practice is to act consistently on the theory that an employee is still an employee, even though absent, it would seem advisable to include such absentee time in the estimate of the standard.

A writer in the *American Economic Review*[1] criticizes the use of average attendance figures on the ground that such use results in the inclusion of absenteeism with turnover, of which it is not a part. So it does. But the substitute he suggests (the average pay-roll figures) would seem to make the matter worse rather than better; for while this makes absentee hours a part of the labor base rather than a part of the labor flow, it further, and unwarrantably, distends the base by including as full-time workers large numbers of broken or short-time employees. This surely is straining at a gnat and swallowing a camel. For the absentee hours which are taken out of the base bulk very small in number when compared with the broken-time hours forced into it by the use of pay-roll numbers. It would not be a matter for criticism that absentee hours are included as a part of the working force, although the advisability of such inclusion is doubtful, if it were not that the method of doing it involves also the inclusion of a large proportion of short-time workers as full-time workers and the consequent undue enlargement of the base. Assuming no absenteeism, we might conceivably have, in a plant using semi-monthly pay-rolls, 100 men working the first week only of the pay period and 200 men working the full pay period. There will then be 300 names on the pay-roll for this particular pay period, whereas the working force was really equivalent to 250 full-pay-period workers. Absentee time can be figured independently in any case, and the amount of it is so slight that it is perhaps immaterial whether it is included or not. Whatever is done, it is to be recognized as something apart from labor mobility and yet often a causal factor in increasing it. On the whole, it is probably better to leave absentee time entirely out of account in the measurement of establishment labor stability.

[1] Note on computation of labor turnover by P. H. Douglas, *American Economic Review*, June, 1919, pp. 402–5. In a recent paper on "Absenteeism in Labor" (*Political Science Quarterly*, XXXIV, December, 1919, pp. 591–608) Mr. Douglas develops this general subject more fully.

X

It would seem from the foregoing discussion that the use of the pay-roll average is the worst possible method for arriving at the standard working force. The broken-time items of under-one-year or under-one-month service must be pieced together to show the amount of full-time employment (time put in plus absentee time). The best way to do this is to get the aggregate total of labor hours (or one-man hours) worked, add to that the number of hours of absentee employment, and divide the total by 3,000. The quotient is the number of 3,000-hour workers. The total number of labor hours might be divided by some other and locally determined figure, say 312, which might fall closer to the actual annual number of days worked by some particular plant. Here, however, its usefulness would end, for such a method would seriously discount the validity, if it did not make entirely impossible the comparison, of labor flux rates in different firms, localities, industries, or occupations. In other words, the only way to standardize labor turnover is to standardize it.

If labor hours are not recorded, the standard working force may be calculated by dividing the total number of man-days worked by 300. This number, which is practically equivalent to the average daily attendance, is slightly smaller than a standard which is based on included absentee hours and slightly larger than the number based exclusively upon labor hours actually worked, but the margin in both cases is believed to be negligible. The figure based exclusively on labor hours actually worked would seem at first glance to be identical with the average attendance method adopted at Rochester. It is actually somewhat smaller, because attendance records include some absentee time, inasmuch as they usually include those who may have been absent, say, during the last half of a day as if they had worked the whole day; whereas the labor-hours base contains only the time actually worked, standardized in terms of full-year units. At any rate, if labor hours are not available, the man-days worked, derived from attendance figures in most cases, constitute a perfectly workable and satisfactory substitute. Whether or not it is possible or desirable to include the absentee time, it is believed that the best method

is to proceed from the actual man-hours or man-days worked. Indeed, it is doubtful if as many plants keep actual attendance records as keep records of labor hours worked. A second alternative method which may be used in getting at the total labor hours is to use the pay-roll figures, dividing the amounts paid out at each hourly rate by that rate and adding the results to get the total number of labor hours. The suggested methods for determining the standard working force, then, are as follows, in the order of preference:

1. Given labor hours (or days):
   Aggregate labor hours ÷ 3000 (or 300)[1]
2. Given attendance records:
   (Average daily attendance × days of operation) ÷ 300
3. Given wage payments:
   Aggregate sum paid at each hourly rate ÷ corresponding rate per hour.

If the number of full-year workers has to be derived from labor days put in, or, what is practically the same thing, from attendance records, the method just given can be applied without modification only to the establishment which operates on the ten-hour day basis, the standard 3,000-hour worker being one whose full-time year is made up of 300 ten-hour days. If the plant operates on an eight-hour basis and there are, say, 4,000 man-days put in, these eight-hour man-days can easily be translated into their equivalent in ten-hour days by multiplying their number by 0.8. Similarly, if the 4,000 days had been worked on a twelve-hour day basis the 4,000 should be multiplied by 1.2.

XI

Having now fixed upon the number of replacements as most accurately measuring the net labor flux, that is to say, that part of the labor flux which is involved in maintenance, and having determined upon the equivalent number of 3,000-hour (or 300-day)

[1] The base as thus computed (resting on labor hours actually worked) is, as already noted, slightly smaller than the base derived under (2), since the latter method often involves such absentee time as results from absence, say, during a part of the afternoon. But if, under method (1), absentee time is added, the resultant base will be slightly larger than the base derived under (2), because the latter obviously includes only a part of the absentee time. It is evident that, under method (2), it is not possible certainly either to entirely include or to entirely exclude absentee time.

workers as the most accurate figure for the standard working force, it is quite obvious that the rate of labor flow is simply the ratio of the variable to the base. If the variable (number of replacements, e.g.,) is divided by the base (the number of 3,000-hour workers), the result is the rate of replacement for each 3,000-hour worker employed or, once the standard is defined, simply the replacement rate per full-year worker. If desired, a rate per 1,000 may be computed by dividing the replacement or flux figure by the number of 3,000-hour workers and multiplying the quotient by 1,000. The rate per single full-year worker, however, is believed to be in general preferable to the rate per 100 or per 1,000 full-year workers, and it has been used, therefore, in the present discussion.

Although the whole method suggested in these pages has its recipe in the phrase describing it (the rate of flux, replacement, accession, or separation per "equivalent full-year worker" employed), a formula will perhaps simplify its use.

Let h = the number of labor hours worked,
a = number of accessions,
s = number of separations,
and e = excess of separations over accessions.

Then the annual labor flux rate per full-year (3,000-hour) worker is

$$\frac{a+s}{h}\times 3{,}000,$$

the replacement rate $\frac{s-e}{h}\times 3{,}000,$

the accession rate $\frac{a}{h}\times 3{,}000,$

the separation rate $\frac{s}{h}\times 3{,}000,$

the labor increase rate $\frac{a-s}{h}\times 3{,}000,$

and the labor decrease rate $\frac{s-a}{h}\times 3{,}000.$

Obviously, if accessions and separations are equal or if the accessions are greater, there is no "excess of separations over accessions" and that factor in the replacement formula is eliminated. If it is

considered advisable to include absentee time with time worked to constitute the standard force, the number of absentee hours can simply be added to the number of labor hours worked and the formula applied as before. When the object is to indicate the changes in the labor flow without regard to its direction, it may be more useful to use the rate of labor flux instead of the replacement rate. These formulas may be applied to data covering various periods of time, a month or a year, etc., but the year should preferably be made the unit. They may, of course, be applied to occupational or departmental subdivisions of the working force, so far as the records make it possible to get the labor hours by occupations or departments. Within the same limitations they may be applied to sex groups. Since all rates are reduced to the standard unit, the full-year (or 3,000-hour) worker, establishments in Massachusetts can be compared with those in California and labor stability in mercantile establishments can be compared with stability in manufacturing establishments, and so on.

No single one of these rates, by itself, is sufficient accurately to measure the various factors which make up the labor mobility problem of a modern industrial establishment. Thus, e.g., the flux rate shows up the total stability situation but does not reveal the true establishment situation. If, for each equivalent full-year worker employed during any given period, two employees enter and two leave the establishment, there are evidently two complete overturns of the work force and the flux rate is, of course, 4.0 per full-year worker. This total labor change or flux rate of 4.0 may actually represent any one of three distinctly different internal establishment situations, the revelation of which is one of the useful functions of accession and separation rates: (1) accession rate 2.0, separation rate 2.0: a "going concern" which is neither expanding nor curtailing its operations; (2) accession rate 3.0, separation rate 1.0: a concern which is undergoing more or less rapid extension of plant; and (3) accession rate 1.0, separation rate 3.0: a concern which is curtailing activities. Any one of these three situations may prevail under the same flux rate. In this particular illustrative case it is a flux rate equivalent to two complete over-

turns of the work force, but one or another of these three different situations is involved in every flux rate, whether it be a rate of 1.0 in a very stable establishment or 9.0 in a highly unstable one.

The results of the various methods of computing turnover mentioned in these pages may be seen in a comparative way by applying them to the experience of some fairly typical establishment. There is such a concern in the Middle West engaged in the manufacture of automobiles. In this factory, during the month of March, 1919, there were put in 246,047 labor hours. The number hired during the month was 647 and the number of separations 396. No absentee time was reported. (1) The establishment figured its turnover as the ratio between the accessions and the average working force. The size of the latter was determined by dividing the labor hours worked during the month by the number of working hours in the month (235). The result is a so-called "turnover percentage" (in exact terms, a rate of accession per 100) of 741. On a single full-year worker basis this figure becomes 7.41. (2) On the basis of the Rochester formula, which used the ratio between separations and the average working force, the "turnover percentage" (separation rate per 100) appears to be 454. On a single full-year worker basis this figure would be 4.54. (3) On the basis proposed in this article it would be

$$396 \div \frac{246{,}047}{3{,}000} = 4.83$$

replacements per full-year worker, or a flux rate of

$$\frac{(647+396)}{\frac{246{,}047}{3{,}000}} = 12.72 \text{ per full-year worker.}$$

On a rate per 100 basis and using replacements, this would give a "turnover percentage" of 483. The effect of counting absentee hours as a part of the base is, of course, to decrease the rate of replacement indicated. The amount of this decrease is easily shown by a hypothetical case: Assume that the absentee hours in the automobile plant referred to amounted to 10 per cent of the

labor hours put in, or 24,605 hours. The introduction of this correction for 10 per cent of absentee time brings down the "turnover" or replacement rate from 4.83 to 4.39 per full-year worker.[1]

XII

The foregoing discussion has dealt only with the more direct method of measuring labor mobility—the simple measurement of its rate of flow in both directions. This, as we have seen, furnishes a good index of the extent of instability—the rate of labor flow—in any establishment as a whole or even in any subdivision (as to sex, department, or occupation) for which records of labor time and numbers entering and leaving are separately available. It is important to note that this direct measurement of labor flow in these labor groups shows the rate of flow for the group as a whole and gives no indications of the distribution of responsibility for the turnover within the group. The fact that there are in a year

[1] Since this was written, the Bureau of Labor Statistics has abandoned the Rochester formula as regards both base and variable. During 1919 it gradually took more and more into consideration the accession as well as the separation rate (to which the Employment Managers' Rochester formula is confined) and even made some use of flux and replacement rates. Also, instead of figuring the rate of labor change on the basis of the average number of employees on the work force (i.e., in attendance), the Bureau decided, first, to put it on the basis of the full-year (3,000-hour) worker and (with the object of getting labor mobility computation upon the same basis as that recently adopted for industrial accidents by the committee on statistics and compensation insurance cost of the International Association of Industrial Accident Boards and Commissions) now finally on the basis of the unit labor hour or some decimal multiple thereof. The accession rate, e.g., is a rate per 10,000 labor hours and is obtained by dividing the number of accessions in any period by the number of labor hours put in during that period and multiplying by 10,000. An accession rate per full-year (3,000-hour) worker of 1.0, which patently means that one man is hired for every (full-time) man on the force, is the same as a rate per 10,000 labor hours of 3.3. The rate per full-year worker is, obviously, more simple. Its rate figures indicate directly the relation between the size of the work force and the amount of flux and indicate at a glance whether the labor flux shown is equivalent to one, more than one, or less than one complete "overturn" of the work force. The Bureau's rates must be divided by 3.3 in order to put them on a comparable footing with rates computed on the equivalent-full-year-worker basis and so get them into direct relation to the standard work-force. Both methods have the advantage of being based directly upon the number of labor hours worked, instead of upon pay-roll. The gist of the new official method is explained in relation to the measurement of industrial accident rates in the *Monthly Labor Review* for January, 1920, pp. 218–19. See also "The Mobility of Labor in American Industry," by Emil Frankel and P. F. Brissenden, *Monthly Labor Review*, June, 1920.

2 replacements in smeltermens' jobs for every full-year smelterman employed in a smelter obviously does not mean that each smelterman worked only six months. Naturally many of them must have left after serving less than one month. And it is these short-time men who are primarily responsible for unnecessary labor shifting. In order to show the proportion in any working force or in any subdivision of a working force of, say, under-one-year men and over-one-year men it is necessary to classify employees (both those on the pay-roll and those who leave during any given time) according to the length of their continuous service. The results of such a classification of the employees of the smelter already mentioned is given in Table VI.

The table shows that 30 per cent of the smeltermen on the pay-roll June 1, 1918, had served more than five years. And yet the replacement rate among smeltermen as a whole was 2.3 per full-year smelter worker. This is partly accounted for by the fact that 55 per cent of the smeltermen on the pay-roll had served less than one year, and still more directly accounted for by the other fact that, of the smeltermen leaving service, 4 per cent had served more than five years, only 11 per cent over one year, and as large a proportion as 89 per cent had served less than one year. As to the general stability situation, the proportions shown in the upper and lower divisions of the rate and percentage columns of Table VI emphasize this fact: that it is the short-time employee who contributes the overwhelmingly greater proportion of the labor turnover. Of the number in service at the end of the year, only 9 per cent had service records of one week or less. On the other hand, 21 per cent of those who left during the year had been employed one week or less. At the other end of the scale it appears that 47 per cent of the active working forces had service records of more than one year, whereas only 11 per cent of those who left during the year had served more than a year. The one-to-two-year and the two-to-three-year groups indicate separation proportions of one-half and one-third their respective strengths in the active working force, while the under-one-week group, as already indicated, contributes a proportion of separations more than twice as great as its relative strength in the working force. This analysis is based on the reasonable assumption that the length-of-service

distribution of the active working force throughout the year studied does not vary to any great extent from the distribution found for the end of the year.

TABLE VI

NUMBER, PER CENT DISTRIBUTION, AND RATE PER FULL-YEAR SMELTER EMPLOYEE, OF ACTIVE AND SEPARATED SMELTER EMPLOYEES WHO HAD SERVED SPECIFIED PERIODS OF TIME†

	NUMBER WHO HAD SERVED EACH SPECIFIED PERIOD OF TIME	PER CENT DISTRIBUTION	RATE PER FULL-YEAR WORKER‡
	Active Employees		
One week or less	31	9	0.08
Over 1 to 2 weeks	17	5	0.04
Over 2 weeks to 1 month	16	5	0.04
Over 1 to 3 months	35	10	0.09
Over 3 to 6 months	28	8	0.07
Over 6 months to 1 year	60	18	0.15
Over 1 to 2 years	19	6	0.05
Over 2 to 3 years	19	6	0.05
Over 3 to 5 years	16	5	0.04
Over 5 years	101	30	0.26
Total	342	100	0.87
	Separated Employees		
One week or less	195	21	0.50
Over 1 to 2 weeks	112	12	0.29
Over 2 weeks to 1 month	165	18	0.42
Over 1 to 3 months	198	22	0.50
Over 3 to 6 months	93	10	0.24
Over 6 months to 1 year	55	6	0.14
Over 1 to 2 years	27	3	0.07
Over 2 to 3 years	16	2	0.04
Over 3 to 5 years	14	2	0.04
Over 5 years	38	4	0.10
Total	913	100	2.33

† See Table III of article on "Labor Turnover in a California Copper Mining and Smelting Company," *Monthly Labor Review*, May, 1919, p. 73.

‡ Based upon standard force of 391 equivalent full-year smeltermen.

The figures in Table VI fail adequately to convey the true situation. The principal difficulty with such a length-of-service classification as that shown in Table VI is that the service periods in the scale are of unequal length and the numbers of those leaving

during those unequal periods are, therefore, not strictly comparable. In Table VII the same set of length-of-service figures is presented in such a way as to make the necessary correction for this disparity between the different service periods. The first two columns are, except for decimals, identical with the corresponding figures for the active employees in Table VI. In column 4 the total number of equivalent full-year smelter workers employed (391) is distributed in the same percentage proportions as are the

TABLE VII

SEPARATION RATE PER FULL-YEAR SMELTER WORKER IN SPECIFIED LENGTH-OF-SERVICE GROUPS†

Length of Service	Employees on Pay-Roll at End of Period		Corresponding Distribution of Equivalent Full-Year Workers	Separations	
	Number	Percentage Distribution		Number	Annual Rate per Full-Year Worker
1	2	3	4	5	6
One week or less	31	9.1	35.6	195	5.5
Over 1 to 2 weeks	17	5.0	19.6	112	5.7
Over 2 weeks to 1 month	16	4.7	18.4	165	9.0
Over 1 to 3 months	35	10.2	39.9	198	5.0
Over 3 to 6 months	28	8.2	32.1	93	2.9
Over 6 months to 1 year	60	17.5	68.4	55	0.8
Over 1 to 2 years	19	5.6	21.9	27	1.2
Over 2 to 3 years	19	5.6	21.9	16	0.7
Over 3 to 5 years	16	4.7	18.4	14	0.8
Over 5 years	101	29.5	115.3	38	0.3
Total	342	100.0	391.5	913	2.3

† Based on allocation of the total number of full-year workers among the different length-of-service groups.

342 smelter workers who were on the pay-roll at the end of the year. This reveals the number of full-year workers assignable to the various length of service groups. Column 5 is identical with the first column of separation figures in Table VI. In column 6 are given the annual rates of separation per full-year worker in each length-of-service group. These figures are obtained by dividing the number of separating employees who have served each specified time period by the number of equivalent full-year workers belonging to that group. The resulting scale of separation rates gives a very good idea of the relative responsibility for excessive labor mobility

of the different service groups and shows that the great bulk of it is caused by the short-time employee, very little of it, indeed, being due to the separation from service of employees who had served more than one year.

A more complete discussion of the uses of length-of-service statistics appeared in an article in the February, 1919, number of the *Monthly Labor Review*.[1] There were suggested in that article some modifications of the regular length-of-service classifications designed to show the average number of persons (both in service and separated) assignable, on the average, to each weekly subdivision of the several unequal service periods; to show, in other words, what was called the "average weekly number" leaving and the corresponding "average weekly" active service distribution. In the article just referred to, the length-of-service figures were also applied to the problem of showing the number of equivalent full-year jobs affected by turnover and the number of these affected jobs having various designated rates of replacement.[2] A similar analysis was made in a subsequent article on labor turnover in the California oil-refining industry.[3] The reader is referred to the two articles mentioned for a detailed discussion of this point.

One other method of measuring labor stability deserves notice. It is described in an article in the February number of the *Journal of Political Economy*.[4] It consists in the determination of the ratio between the number of workers actually employed and the number of equivalent full-time workers—called by the writer of the article the "number of available positions." This equivalent number of full-time workers is obtained by dividing the total number of hours actually worked "by the number of hours worked by one who is employed all the year round," which in turn is obtained by a roundabout process of eliminating days not worked in the locality,

[1] P. F. Brissenden, "Labor Turnover in the San Francisco Bay Region," *Monthly Labor Review*, February, 1919, pp. 45–62.

[2] *Monthly Labor Review*, February, 1919, pp. 59–62.

[3] P. F. Brissenden, "Labor Policies and Labor Turnover in the California Oil-Refining Industry," *Monthly Labor Review*, April, 1919, pp. 47–51.

[4] Boris Emmet, "The Nature and Computation of Labor Turnover," *Journal of Political Economy*, February, 1919, pp. 105–16.

absentee time, etc.[1] The number of workers actually employed is found by an actual census of the working force. The percentage excess of this number actually employed over the number of equivalent full-time workers is presented as the "percentage of turnover." This method does represent the extent of instability or turnover very accurately, but the method would be just as accurate and more useful if the base in the calculation (the equivalent number of full-time workers) were worked out more along the lines indicated in the foregoing pages. Moreover, it is to be noted that the method adopted for computing the time worked by a "fully employed person," while sufficiently accurate for the local group or establishment covered, is quite useless for purposes of comparison with other industries or localities. The number of equivalent full-year workers can be really standardized only by dividing the total labor hours by 3,000, or by some other standard employment unit which may be agreed upon. But even with these modifications, this method would seem to be of less practical value than the method of comparing the replacements with the standard force, because it does not show directly—as does the replacement method—the actual flow of labor in and out of the establishment. The greatest difficulty involved in Mr. Emmet's method is that very few concerns have records in such shape as to make it possible to work out the problem on the lines proposed without an enormous amount of work.

XIII

The establishment records primarily needed for the development of useful statistics of labor mobility on the lines indicated in the body of this article are:

1. Number of man-hours (or man-days) worked
   a) In the shape of clock records, or
   b) Daily attendance records, or
   c) To be derived from amounts paid out in wages at various rates
2. Number of accessions
3. Number of separations
   a) Number leaving voluntarily
   b) Number laid off
   c) Number discharged

[1] *Ibid.*, p. 107, note.

These items represent the most important data necessary. As to each item, the information should be recorded by months, and separately, so far as possible, for departmental, occupational, and other subdivisions of the working force. If absentee hours are to be included in the computation, a record of such absentee time will, of course, have to be kept. Indeed, such a record should be kept in any case and quite apart from the investigation of labor mobility, so that it may be possible to determine the establishment's percentage of absenteeism.

Length-of-service statistics are very important. If the individual service records are to be tabulated as a part of the establishment records, it would be well to agree upon some common standard classification of service periods. This classification should be split up very fine in the short-service end of the scale, at least to the extent of showing the number who have worked one week, or if possible even less. It should show separately active and separated employees and, as far as possible, the various departmental and occupational subdivisions of the working force.

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